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ABSTRACT

This guide provides information to enable coordinators to direct learning activities for students using an individualized study guide on operating a lathe. The study material is designed for students enrolled in cooperative part-time training and employed, or desiring to be employed, as lathe operators. Contents include a sample progress chart, suggested teaching procedures for the coordinators, answers to assignment sheets, answers to a unit test, a sheet with the study guide objective and specific objectives, 12 information sheets, 18 assignment sheets, and an eight-part unit test. The information sheets cover these topics: introduction to lathe operations, basic hand and power tools, headstock accessories, carriage accessories, tailstock accessories and other accessories, terms and definitions, basic lathe operations, things to consider when running speeds and feeds, knurling, tool post grinding, filing and polishing, and cleaning and lubricating the lathe. (YLB)

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ED240371

Individualized Study Guide

General Metal Trades

LATHE OPERATOR

Coordinator's Guide

Prepared under the direction of
Bill Barnes, Ph.D.

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LATHE OPERATOR

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FOREWORD

This individualized study guide has been developed for the student who is enrolled in Cooperative Part-time Training and who is employed or desires to be employed as a lathe operator. The study material is designed to provide the student with general information for immediate reinforcement on the job and to develop an understanding of the job prior to employment.

Even though these study guides are individualized, the coordinator should closely supervise each student's studies. To allow the coordinator to better direct the learning activities, both coordinator guides and student manuals are available. A progress chart provided in each student manual will allow the coordinator to pinpoint the progress a student has made toward each objective in the sequence in which they are completed.

Appreciation is expressed to those whose expertise made possible the development of these study guides. The assistance of these instructors in the development process assures that the materials are currently of use to vocational teachers in Texas. The following instructors provided valuable assistance in the development process:

Fred Aikin	Mt. Pleasant High School	Mt. Pleasant, Texas
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D. G. Gober	Monahans High School	Monahans, Texas
James Loracano	Tyler High School	Tyler, Texas

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Bill Barnes, Ph.D., Director
Occupational Curriculum Laboratory

Progress Chart for

LATHE OPERATOR

Name

School

		Date Completed
INFORMATION SHEET 1	INTRODUCTION TO LATHE OPERATIONS	
ASSIGNMENT SHEET 1	USE OF A PRODUCTION LATHE	
ASSIGNMENT SHEET 2	PARTS OF THE LATHE	
ASSIGNMENT SHEET 3	SAFETY	
ASSIGNMENT SHEET 4	SAFETY	
Test	Part 1	
OBJECTIVE	Identify types of lathes, identify the parts of the lathe, and point out the correct safety practices to follow when operating the lathe.	
INFORMATION SHEET 2	BASIC HAND AND POWER TOOLS	
ASSIGNMENT SHEET 5	BASIC HAND AND POWER TOOLS	
Test	Part 2	
OBJECTIVE	Identify the basic hand and power tools used in lathe operations.	
INFORMATION SHEET 3	HEADSTOCK ACCESSORIES	
ASSIGNMENT SHEET 6	HEADSTOCK ACCESSORIES TERMS	
ASSIGNMENT SHEET 7	HEADSTOCK ACCESSORIES	
Test	Part 3	
OBJECTIVE	Identify accessories available for a lathe headstock.	
INFORMATION SHEET 4	CARRIAGE ACCESSORIES	
ASSIGNMENT SHEET 8	CARRIAGE ACCESSORIES TERMS	
Test		
OBJECTIVE	Identify accessories available for a lathe carriage.	

		Date Completed
INFORMATION SHEET 5	TAILSTOCK ACCESSORIES AND OTHER ACCESSORIES	
ASSIGNMENT SHEET 9	TAILSTOCK AND OTHER ACCESSORIES	
Test	Part 5	
OBJECTIVE	Identify the accessories used on a lathe tailstock.	
INFORMATION SHEET 6	TERMS AND DEFINITIONS	
ASSIGNMENT SHEET 10	TERMS AND DEFINITIONS	
Test	Part 6	
OBJECTIVE	Match terms associated with lathe operations to the correct definition.	
INFORMATION SHEET 7	BASIC LATHE OPERATIONS	
ASSIGNMENT SHEET 11	OPERATIONS	
Test	Part 7	
OBJECTIVE	Identify each of the operations performed on a lathe.	
INFORMATION SHEET 8	RUNNING SPEEDS AND FEEDS	
ASSIGNMENT SHEET 12	FIGURING RPM	
ASSIGNMENT SHEET 13	FIGURING TAPER PER FOOT	
ASSIGNMENT SHEET 14	FIGURING TAILSTOCK OFFSET	
Test	Part 8	
OBJECTIVE	Point out things to consider when running speeds and feeds.	
INFORMATION SHEET 9	KNURLING	
ASSIGNMENT SHEET 15	KNURLING	
OBJECTIVE	Point out things to consider when setting up the lathe for knurling.	
INFORMATION SHEET 10	TOOL POST GRINDING	
ASSIGNMENT SHEET 16	TOOL POST GRINDING	

		Date Completed
OBJECTIVE	Point out things to consider when setting up the lathe for tool post grinding.	
INFORMATION SHEET 11	FILING AND POLISHING	
ASSIGNMENT SHEET 17	FILING AND POLISHING	
OBJECTIVE	Point out things to consider when setting up the lathe for filing and polishing.	
INFORMATION SHEET 12	CLEANING AND LUBRICATING THE LATHE	
ASSIGNMENT SHEET 18	CLEANING AND LUBRICATING THE LATHE	
OBJECTIVE	Point out things to consider when cleaning and lubricating the lathe.	

This student has completed the indicated training under my supervision.

_____
Teacher

LATHE OPERATOR

SUGGESTED TEACHING PROCEDURES FOR THE COORDINATOR

I. Objective Sheet

A. Discuss each objective with the students.

B. Have students complete the objectives in the most logical sequence for class organization.

C. Add any objectives necessary.

II. Answers to Assignment Sheets

A. Provide the student answers to any questions missed.

B. Provide additional questions for areas missed on assignments.

III. Answers to the test--Answers are based on total information provided in the study guide.

IV. Information and Assignment Sheets

A. INFORMATION SHEET 1--INTRODUCTION TO LATHE OPERATIONS

1. Discuss the types of lathes used in production shops.

2. Discuss the parts of the lathe.

3. Discuss the safety factors relating to lathe operations.

4. Use the following assignment sheets to reinforce this area of information:

a. ASSIGNMENT SHEET 1--USE OF A PRODUCTION LATHE

b. ASSIGNMENT SHEET 2--PARTS OF THE LATHE

c. ASSIGNMENT SHEET 3--SAFETY

d. ASSIGNMENT SHEET 4--SAFETY

B. INFORMATION SHEET 2--BASIC HAND AND POWER TOOLS

1. Discuss the types of hand tools used in production shops.

2. Discuss the types of measuring tools used in production shops.

3. Discuss the types of power tools used in production shops.

4. Use ASSIGNMENT SHEET 5--BASIC HAND AND POWER TOOLS to reinforce this area of information.

C. INFORMATION SHEET 3--HEADSTOCK ACCESSORIES

1. Discuss the types of Headstock Accessories used in production shops.

2. Use the following assignment sheets to reinforce this area of information:

   a. ASSIGNMENT SHEET 6--HEADSTOCK ACCESSORIES TERMS

   b. ASSIGNMENT SHEET 7--HEADSTOCK ACCESSORIES

D. INFORMATION SHEET 4--CARRIAGE ACCESSORIES

1. Discuss the types of Carriage Accessories used in production shops.

2. Use ASSIGNMENT SHEET 8--CARRIAGE ACCESSORIES TERMS to reinforce this area of information.

E. INFORMATION SHEET 5--TAILSTOCK ACCESSORIES AND OTHER ACCESSORIES

1. Discuss the types of Tailstock Accessories.

2. Discuss the other accessories.

3. Use ASSIGNMENT SHEET 9--TAILSTOCK AND OTHER ACCESSORIES to reinforce this area of information.

F. INFORMATION SHEET 6--TERMS AND DEFINITIONS

1. Discuss the terms and definitions used in production shops.

2. Use ASSIGNMENT SHEET 10--TERMS AND DEFINITIONS to reinforce this area of information.

G. INFORMATION SHEET 7--BASIC LATHE OPERATIONS

1. Discuss the Basic Lathe Operations used in production shops.

2. Use ASSIGNMENT SHEET 11-OPERATIONS to reinforce this area of information.

H. INFORMATION SHEET 8--RUNNING SPEEDS AND FEEDS

1. Discuss the things to consider when running speeds and feeds in a production shop.

2. Use the following Assignment Sheets to reinforce this area of information:

a. ASSIGNMENT SHEET 12--FIGURING RPM

b. ASSIGNMENT SHEET 13--FIGURING TAPER PER FOOT

c. ASSIGNMENT SHEET 14--FIGURING TAILSTOCK OFFSET

I. INFORMATION SHEET *9--KNURLING

1. Discuss knurling.

2. Use ASSIGNMENT SHEET 15--KNURLING to reinforce this area of information.

J. INFORMATION SHEET 10--TOOL POST GRINDING

1. Discuss tool post grinding.

2. Use ASSIGNMENT SHEET 16--TOOL POST GRINDING to reinforce this area of information.

K. INFORMATION SHEET 11--FILING AND POLISHING

1. Discuss filing and polishing in the production shop.

2. Use ASSIGNMENT SHEET 17--FILING AND POLISHING to reinforce this area of information.

L. INFORMATION SHEET 12--CLEANING AND LUBRICATING THE LATHE

1. Discuss cleaning and lubricating a lathe in the production shop.

2. Use ASSIGNMENT SHEET 18--CLEANING AND LUBRICATING THE LATHE to reinforce this area of information.

V. Test

A. The test is divided into eight parts.

B. Various approaches may be used in testing:

1. Each part of the test may be given as the student reviews the information sheet.

2. Give one or more parts of the test as an additional assignment, or to reinforce areas the students did not understand.

*INFORMATION SHEETS 9-11 may be used if students have lathes at their training stations.

LATHE OPERATOR

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet 1

Evaluated to the satisfaction of the instructor.

Assignment Sheet 2

A.
1. Feed reverse lever
2. Cone pulley cover
3. Faceplate
4. Spindle
5. Bed
6. Lead screw
7. Screw feed levers

B.
1. Saddle
2. Cross slide
3. Tool post
4. Compound rest
5. Compound cross-feed cranks
6. Micrometer collars
7. Carriage lock
8. Thread chasing dial
9. Apron
10. Half-nut lever
11. Clutch and brake handle
12. Power-feed lever
13. Carriage handwheel

C.
1. Ram
2. Ram lock lever
3. Dead center
4. Handwheel
5. Tailstock lock lever
6. Centering offset screws
7. Housing

Assignment Sheet 3

A.
1. Eye protection
2. Ear protection
3. Snug-fitting clothes
4. Short sleeves or rolled-up long sleeves
5. Long hair tied back or in a cap
6. Protective apron or overalls

B.
1. Permission
2. One
3. Brush
4. Rag
5. Careful
6. Immediately
7. Supervisor
8. Lathe

Assignment Sheet 4

Evaluated to the satisfaction of the instructor.

Assignment Sheet 5

A. 13
B. 6
C. 12
D. 7
E. 1
F. 8
G. 5
H. 2
I. 3
J. 4
K. 10
L. 11
M. 9
N. 14

Assignment Sheet 6

A. 6
B. 5
C. 4
D. 1
E. 3
F. 2

Assignment Sheet 7

A. Two-jaw universal
B. Three-jaw universal
C. Six-jaw combination
D. Threaded spindle
E. Cam-lock spindle
F. Collet
G. Lathe dog
H. Faceplate

Assignment Sheet 8

A. 4
B. 6
C. 1
D. 2
E. 5
F. 3
G. 7
H. 8

Assignment Sheet 9

A. 3
B. 6
C. 4
D. 5
E. 2
F. 1

Assignment Sheet 10

1. F
2. T
3. T
4. F
5. F
6. T
7. T
8. F
9. T
10. T

Assignment Sheet 11

H 1.

D 2.

G 3.

E 4.

F 5.

C 6.

A 7.

B 8.

Assignment Sheet 12

A. 1. 815
2. 458
3. 244
4. 357
5. 437
6. 344
7. 424
8. 222
9. 153
10. 382

B. 1. 400
2. 240
3. 240
4. 60
5. 112
6. 1280
7. 800
8. 400
9. 640
10. 320

Assignment Sheet 13

A.	1.99	F.	1.78
B.	.75	G.	.36
C.	.99	H.	2.97
D.	.30	I.	.36
E.	.43	J.	6.86

Assignment Sheet 14

A.	.25	F.	.23
B.	.12	G.	.09
C.	.06	H.	.81
D.	.17	I.	1.66
E.	.44	J.	1.70

Assignment Sheet 15

A.
1. Chuck
2. Knurling tool and holder
3. Workpiece
4. Cutting oil
5. Shop rag

B.
1. Chuck the workpiece.
2. Set up the correct feed and speed for knurling.
3. Mark off the section of the workpiece to be knurled.
4. Place the tool in the tool post so it is 90° and on center of the workpiece.
5. Start the lathe and dial the crossfeed toward the workpiece until a pattern is clearly formed.
6. Start the automatic feed.
7. Apply coolant or cutting fluid often.
8. Stop the machine when the knurls reach the left mark.
9. Reverse the spindle direction and apply more crossfeed pressure.
10. Stop the tool at the right starting point.
11. Make additional passes until the specified knurl is formed.
12. Clean up the lathe and turn in the tools.
13. Turn in the workpiece to your instructor.

Assignment Sheet 16

A. 1. Tool post grinder
2. Workpiece (or lathe center)
3. Shop rag

B. 1. Place the center in the headstock.
2. Align the tool post grinder at 90° to the compound rest and fasten securely.
3. Adjust the compound rest to a 30° angle from center line.
4. Reverse the direction of rotation of the lathe spindle.
5. Set the RPM of the lathe.
6. Adjust the grinder to the starting point.
7. Start the lathe and the grinder.
8. Feed the grinder into the center with the cross slide.
9. Feed the grinder along with the compound rest crank.
10. Make several passes until the workpiece is smoothly, evenly ground.
11. Clean up the lathe and turn in the tools.
12. Hand in the workpiece to your instructor.

Assignment Sheet 17

A. 1. Chuck
2. Workpiece
3. Parallel lathe file
4. Emery cloth
5. File card
6. Micrometers

B. 1. Chuck the workpiece.
2. Filing
   a. Set the RPM at the correct speed for filing.
   b. Start the lathe.
   c. File across the workpiece at an angle from the tail-stock end of the lathe.
   d. Use long strokes with a slight angle on the file.
   e. File the workpiece to within .001 to .002 for polishing.
3. Polishing
   a. Set the RPM at the correct speed for polishing.
   b. Start the lathe.
   c. Place the emery cloth around the workpiece.

d. Move the emery cloth back and forth and up and down the length of the workpiece.

e. Stop the machine and check the workpiece several times during polishing.

f. Polish the workpiece to the specified diameter.

4. Clean up the lathe and turn in the tools.

5. Hand in the workpiece to your instructor.

Assignment Sheet 18

A. 1. Cleaning brush
2. Shop rag
3. Oil can
4. Cleaning solvent
5. Broom
6. Dust pan
7. Floor sweep

B. 1. Brush all chips from the carriage and ways.
2. Wipe all dirt and oil from the lathe with a shop rag.
3. Wipe the lathe down with cleaning solvent.
4. Dry the lathe with a shop rag.
5. Apply a thin coat of oil to the ways and ground surfaces of the lathe.
6. Oil spindle threads or cams and any oilers on the lathe.
7. Oil the motor and other oilers in the motor housing if required.
8. Wipe off the exterior surfaces of the lathe.
9. Sweep up chips around the lathe.
10. Pick up chips with the dust pan.
11. Sprinkle floor sweep on any oily spots.
12. Place cleaning rags, solvent, oil, and equipment in proper storage.

LATHE OPERATOR

ANSWERS TO TESTS

Part 1

1. Explanation should include:

   a. The engine lathe is a power-driven machine tool which removes metal from a workpiece by rotating the workpiece against a single-point cutting tool.

   b. The engine lathe is capable of performing any operation needed to machine any replacement part on the lathe.

2. a. Engine

   b. Turret

3. a. Headstock
   b. Screw feed levers
   c. Spindle
   d. Bed
   e. Compound cross-feed crank
   f. Compound rest
   g. Tailstock
   h. Lead screw
   i. Set screw
   j. Carriage
   k. Feed reverse levers

4. a. 3
   b. 1
   c. 1
   d. 3
   e. 1
   f. 3

Part 2

A. 13	E. 1	I. 3	M. 9
B. 6	F. 8	J. 4	N. 14
C. 12	G. 5	K. 10	
D. 7	H. 2	L. 11	

Part 3

1. a. Camlock spindle
   b. Lathe dog
   c. Collets
   d. Faceplate
   e. Three-jaw
   f. Four-jaw

ANSWERS TO TEST

Part 4

1. a. Knurling tool
   b. Boring bar
   c. Taper attachment
   d. Right-hand offset tool holder
   e. Follow-rest
   f. Tool post grinder
   g. Rocker tool post
   h. Four-way tool post
   i. Open-side tool post

Part 5

1. a. Ball bearing center
   b. Solid center
   c. Pipe center

Part 6

1. a. 8
   b. 6
   c. 12
   d. 4
   e. 1
   f. 3
   g. 9
   h. 7
   i. 2
   j. 10
   k. 11
   l. 5

Part 7

1. a. Knurling
   b. Chamfering
   c. Parting
   d. Facing
   e. Grinding
   f. Center drilling
   g. Shoulder turning
   h. Straight turning
   i. Taper turning
   j. Reaming
   k. Boring
   l. Threading

Part 8

1. a. ✓
   b. _____
   c. _____
   d. ✓
   e. ✓
   f. ✓
   g. ✓
   h. ✓
   i. ✓

2. Evaluated to the satisfaction of the instructor.

3.

A.	1.	815	6.	344
	2.	458	7.	424
	3.	244	8.	222
	4.	357	9.	153
	5.	437	10.	382
B.	1.	400	6.	1280
	2.	240	7.	800
	3.	240	8.	400
	4.	60	9.	640
	5.	112	10.	320
C.	1.	1.99	6.	1.78
	2.	.75	7.	.36
	3.	.99	8.	2.97
	4.	.30	9.	.36
	5.	.43	10.	6.86
D.	1.	.25	6.	.23
	2.	.12	7.	.09
	3.	.06	8.	.81
	4.	.17	9.	1.66
	5.	.44	10.	1.70

LATHE OPERATOR

STUDY GUIDE OBJECTIVE

Upon completion of this study guide, the student will be able to use the proper terms and understand the safety rules to be observed when performing the various operations required in operating a lathe. The student will be able to identify the types of lathes, the parts of an engine lathe, and the accessories used on the engine lathe. This knowledge will be evidenced by satisfactorily completing the study guide test.

SPECIFIC OBJECTIVES

After completing this study guide, the student will be able to:

1. Identify types of lathes, identify the parts of the lathe, and point out the correct safety practices to follow when operating the lathe.
2. Identify the basic hand and power tools used in lathe operations.
3. Identify accessories available for a lathe headstock.
4. Identify the accessories used on a lathe carriage.
5. Identify the accessories used on a lathe tailstock.
6. Match terms associated with lathe operations to the correct definition.
7. Identify each of the operations performed on a lathe.
8. Point out things to consider when running speeds and feeds.
9. Point out things to consider when setting up the lathe for knurling.
10. Point out things to consider when setting up the lathe for tool post grinding.
11. Point out the things to consider when setting up the lathe for filing and polishing.
12. Point out the things to consider when cleaning and lubricating the lathe.

INFORMATION SHEET 1--INTRODUCTION TO LATHE OPERATIONS

I. The engine lathe

A. The engine lathe is a power-driven machine tool which removes metal from a workpiece by rotating the workpiece against a single-point cutting tool.

B. The engine lathe is capable of performing any operation needed to machine any replacement part on the lathe.

II. Types of lathes

A. Engine lathe

1. Drives

a. Belt-driven

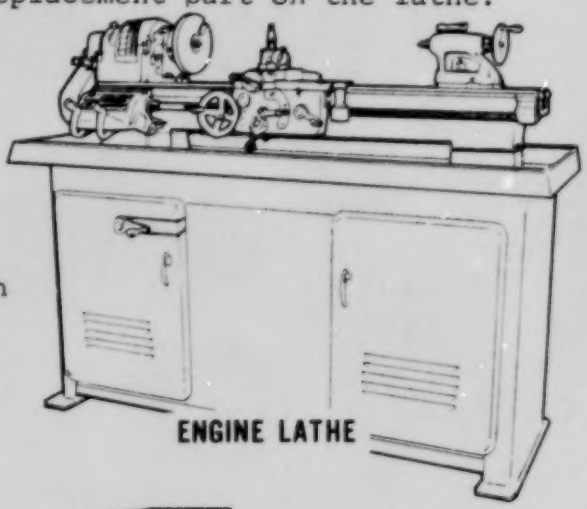
b. Gear head-driven

2. Designs

a. Gap lathe

b. Bench lathe

c. Tool room

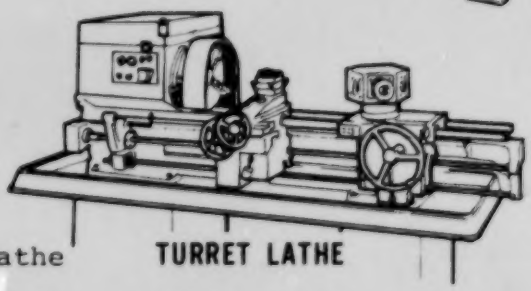


ENGINE LATHE

B. Turret lathe

1. Horizontal

2. Vertical



TURRET LATHE

C. Numerical control (NC) lathe

1. A programmed lathe used to perform a number of operations on the workpiece without the machine operator's assistance.

2. Holds close tolerances even with rapid output of parts.

D. Automatic lathes--Used where rapid production of easily machined parts and little operator assistance is required.

1. Single-spindle

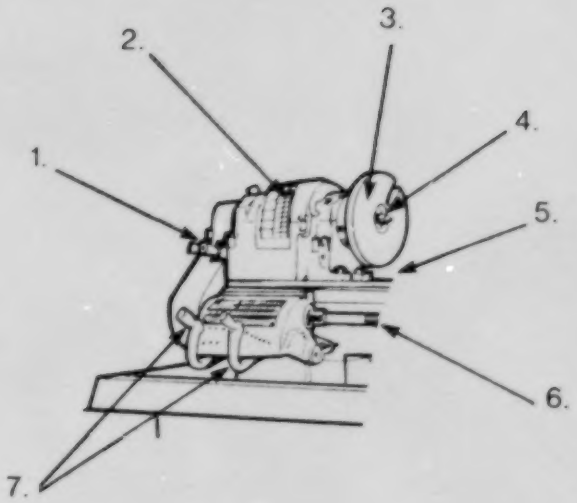
2. Multiple-spindle

E. Tracer lathe--Used when parts can be duplicated from a master part with simple operations of the lathe.

III. Parts of the lathe

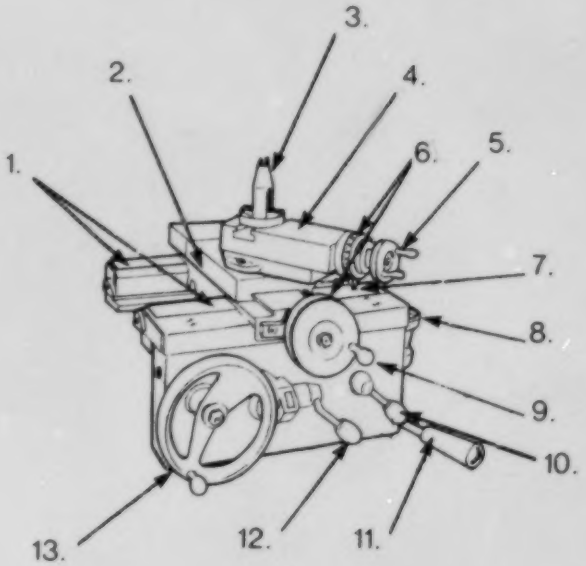
A. Headstock

1. Feed reverse lever
2. Cone pulley cover
3. Faceplate
4. Spindle
5. Bed
6. Lead screw
7. Screw feed levers



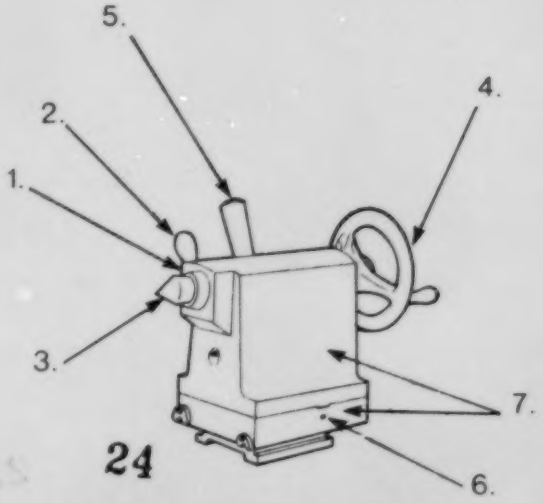
B. Carriage

1. Saddle
2. Cross slide
3. Tool post
4. Compound rest
5. Compound cross-feed cranks
6. Micrometer collars
7. Carriage lock
8. Thread chasing dial
9. Apron
10. Half-nut lever
11. Clutch and brake
12. Power-feed lever
13. Carriage handwheel



C. Tailstock

1. Ram
2. Ram lock lever
3. Dead center
4. Handwheel



5. Tailstock lock lever

6. Centering offset screws

7. Housing

IV. Safety

A. Wear protective clothing

1. Eye protection

2. Ear protection

3. Snug-fitting clothes

4. Short sleeves or rolled-up long sleeves

5. Long hair must be contained with a cap or tied back

6. A protective apron or coveralls

(NOTE: Remove rings, watches, or other jewelry before operating a lathe.)

B. Operate a lathe only after you have received proper instructions.

1. Always get permission from the instructor before operating the lathe.

2. Allow only one operator to control the lathe.

C. Stop the lathe before making adjustments or removing chips.

1. Remove chips with a brush.

2. Never wipe moving parts with a rag.

3. Do not shift gears while the lathe is running.

4. Stop the lathe before attempting to measure parts.

5. Keep hands and fingers away from moving parts.

D. Handle tools and accessories properly and do not lay them on the bed or saddle.

1. Get help when lifting heavy chucks or accessories.

2. Use a board or wood block to protect the ways when installing a chuck.

3. Remove the chuck wrench from the chuck <u>after</u> adjusting the jaws of the chuck.

4. Be careful with sharp or pointed tools.

5. Keep handles on files and deburring tools.

6. Stand to one side when filing.

E. Use the lathe correctly and provide proper maintenance.

1. Keep all guards in place.

2. Report all needed repairs to your supervisor.

3. Do not operate a lathe with faulty parts.

4. Clean up spilled oil or coolant immediately.

5. Check the chuck and workpiece for clearance by hand before turning on the power.

F. Do not allow horseplay around the lathe.

1. Stand erect, keep alert, and do not lean on the lathe.

2. Never leave a lathe unattended.

3. Do not talk to another lathe operator while the lathe is running.

4. Do not play with compressed air.

LATHE OPERATOR

ASSIGNMENT SHEET 1--USE OF A PRODUCTION LATHE

DIRECTIONS: Using the space below or another sheet of paper, give the brand name of a production lathe used at your work station. Draw any pictures of the equipment or use cut-outs which will better explain the type of equipment you use. Some suggested machines are:

A. Automatic lathes

B. Turret lathe

C. Engine lathe

D. Numerical control lathe

E. Tracer lathe

F. Tailstock

G. Headstock

H. Carriage

I. Safety

ASSIGNMENT

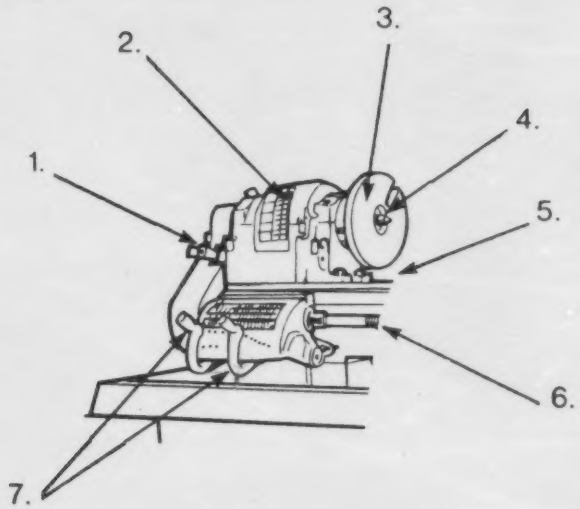
LATHE OPERATOR

ASSIGNMENT SHEET 2--PARTS OF THE LATHE

Identify the parts of the lathe:

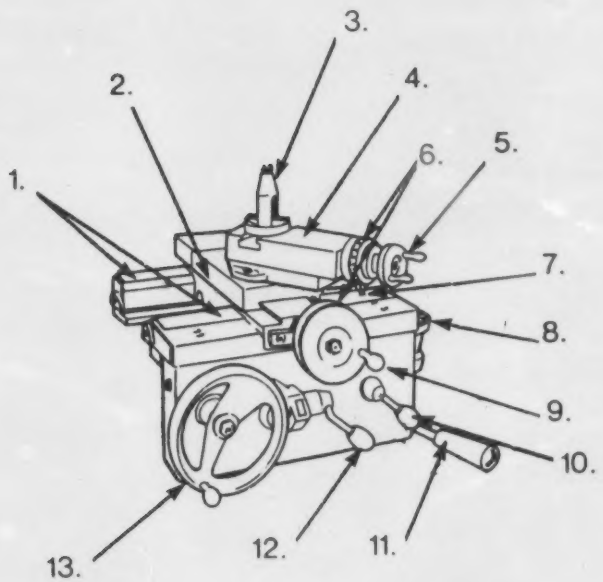
A. Headstock

1.
2.
3.
4.
5.
6.
7.



B. Carriage

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.



ASSIGNMENT

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C. Tailstock

1.

2.

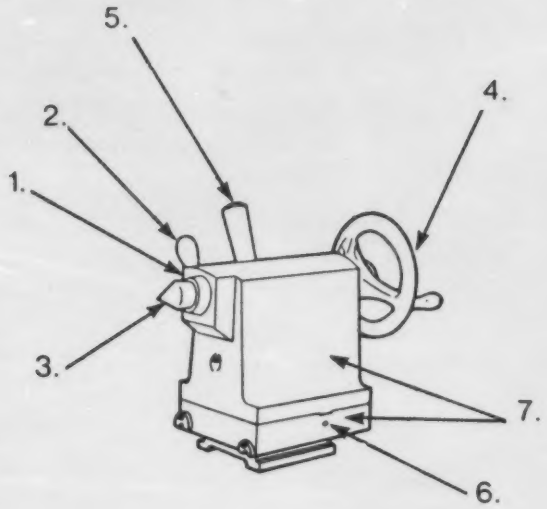
3.

4.

5.

6.

7.



LATHE OPERATOR

ASSIGNMENT SHEET 3--SAFETY

DIRECTIONS: Complete the statements about safety by listing and filling in the blanks.

A. Wear protective clothing such as:

1.

2.

3.

4.

5.

6.

B. Fill in the blanks:

1. Always get _____ from the instructor before operating the lathe.

2. Allow only _____ person/persons to control the lathe.

3. Remove chips with a _____.

4. Never wipe moving parts with a _____.

5. Be _____ with sharp or pointed tools.

6. Clean up spilled oil or coolant _____.

7. Report all needed repairs to your _____.

8. Never leave a _____ unattended.

ASSIGNMENT

LATHE OPERATOR

ASSIGNMENT SHEET 4--SAFETY

DIRECTIONS: Develop safety posters for one lathe operation and for cleaning a lathe.

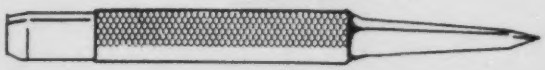
ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 2--BASIC HAND AND POWER TOOLS

I. Hand tools

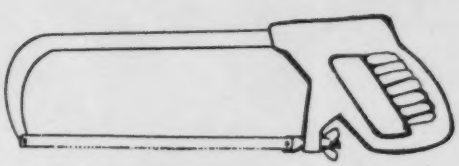
A. Prick punch--used first to mark the point where the centerlines intersect because of its sharp point.



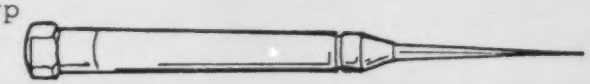
B. Center punch--used after the prick punch mark has been checked and found on center to enlarge the mark for drilling holes in metal.

C. File--used to remove considerable metal, produce a smooth surface for layout work, and produce keen edges on tools. CAUTION: Never use a file without a handle. It is too easy to drive the unprotected tang into your hand.

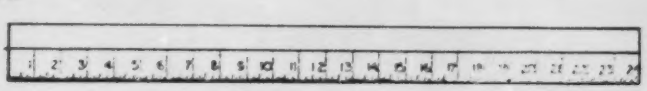
D. Hacksaw--used for cutting metal by hand. The frame is usually adjustable to different length blades.



E. Scribe--used to scribe or to scratch fine lines in a metal layout when accuracy is very critical. The point is made of hardened steel and kept needle sharp by frequent honing on a fine oilstone. CAUTION: Never carry an open scriber in your pocket.

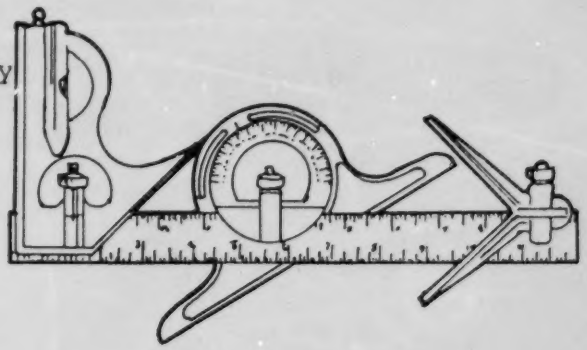


F. Steel rule or bench rule--used to lay off short measurements or to make straight lines. This rule is usually 24" long and is used for bench work only since it cannot be carried in the pocket.

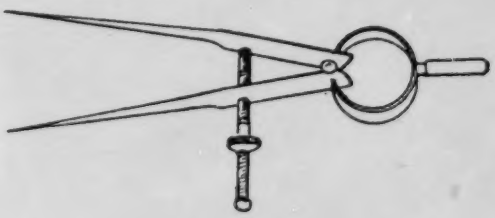


G. Steel pocket tape--available in different lengths, the steel blade is rigid enough for measuring straight surfaces, but it is also flexible enough for measuring curved or irregular surfaces.

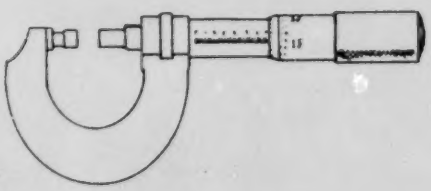
H. Combination square set--adaptable to a large variety of operations in the shop. The complete combination set consists of a hardened blade, square head, center head, and a bevel protractor.



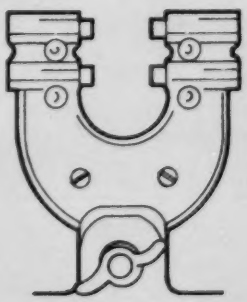
I. Divider--used for laying out circles, parts of circles, and for stepping off equal measurements. It is essential that both legs of the tool be equal in length and kept pointed.



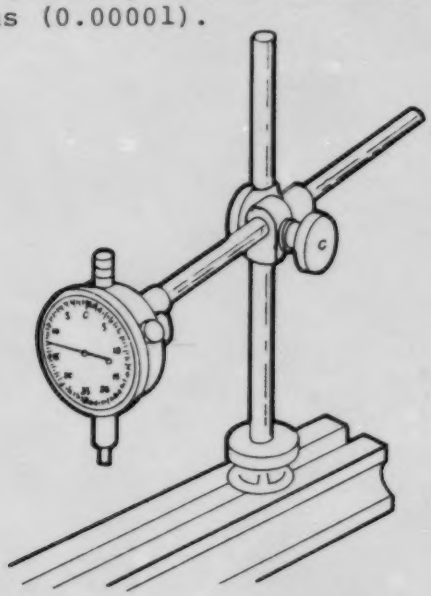
J. Outside micrometer caliper--used to measure outside diameters and thicknesses of material, parts, etc. Generally reads to the nearest one-thousandths (1/1000 or 0.001).



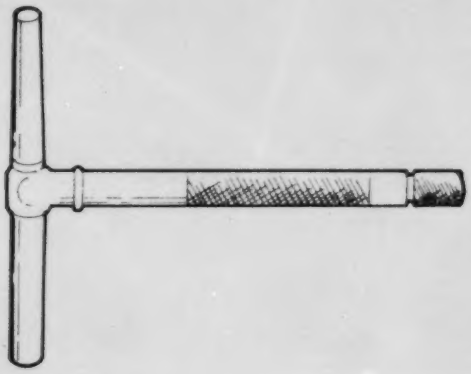
K. Go and No-Go gages--often called <u>limits gages</u>. Sometimes they are called <u>double gages</u> because they have two gaging points or surfaces. One tests the upper size limit, and the other tests the lower size limit of a part being gaged. The sizes generally are stamped on the gage. Common types of go and no-go gages include snap gages, ring gages, and plug gages.



L. Dial indicator--Also called a dial gage and looks somewhat like a watch. The dial indicator visually shows the amount of error, in size or alignment, for a part being measured or gaged. It may be used for gaging height, gaging thickness, and checking straightness or alignment of machined parts. The graduations or the dial indicator are generally indicated in thousandths (0.001), ten thousandths (.0001), and in hundred thousandths (0.00001).



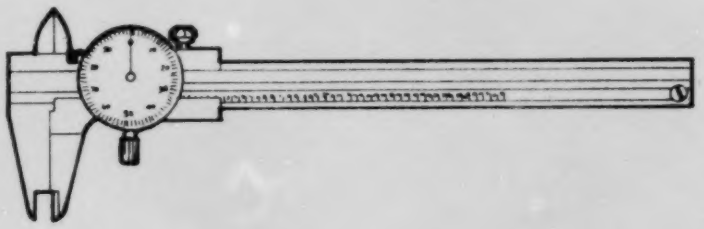
M. Telescoping gage--used with the micrometer to determine inside measurements such as holes and grooves. To use the gage, compress the contact points which telescope within one another under spring tension, insert it into the hole or groove, and permit the contacts to expand. After the proper fitting is obtained, lock the contacts into position by tightening the knurled nut on the end of the handle. Remove the gage and measure the distance across the ends with a micrometer.



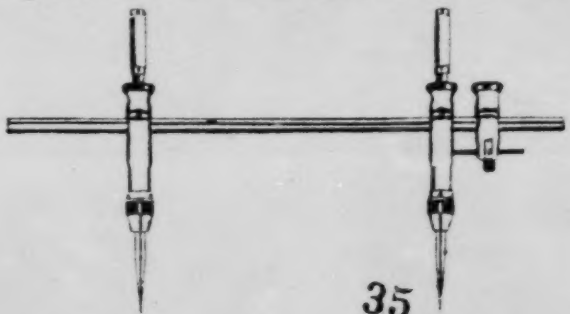
N. Small hole gage--used to measure smaller openings than is possible with telescoping gages. The contacts are designed to permit accurate measurement of shallow grooves and are adjusted to size by the knurled knob at the end of the handle. Measurement is made over the contacts with a micrometer.

O. Hermaphrodite caliper--A layout tool which has one leg shaped like a caliper and the other leg pointed like a divider. The tool is used to lay out lines parallel to the edge of the material and to locate the center of irregularly shaped stock.

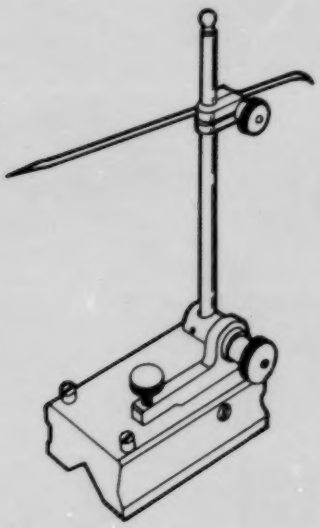
P. Vernier caliper--used to make both inside and outside measurements. The vernier caliper can make accurate measurement to 1/1000 (0.001) in.



Q. Trammel--used to scribe arcs or circles too large for ordinary dividers. It may also be used for locating different dimensions in a straight line. Moreover, it can be used as either inside or outside calipers simply by removing the standard trammel points and inserting curved caliper legs in their places.

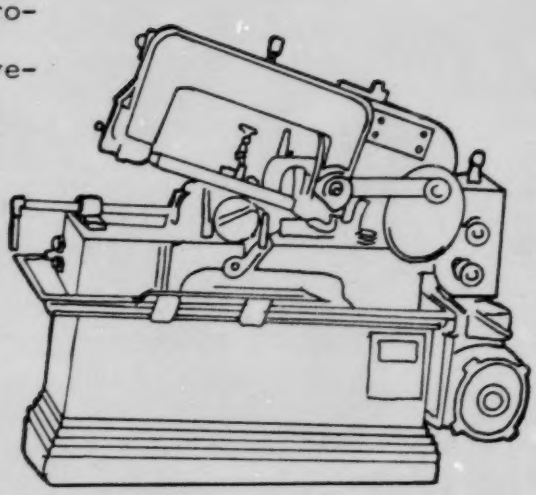


R. Surface gage -used for many purposes, but is most frequently used for layout work. The surface gage can be used for scribing lines at a given height and parallel to a flat surface. It can also be used to level castings in a machine, to line up cutting tools or workpieces, or with an attached indicator, for inspection and checking of machine spindles and workpieces.

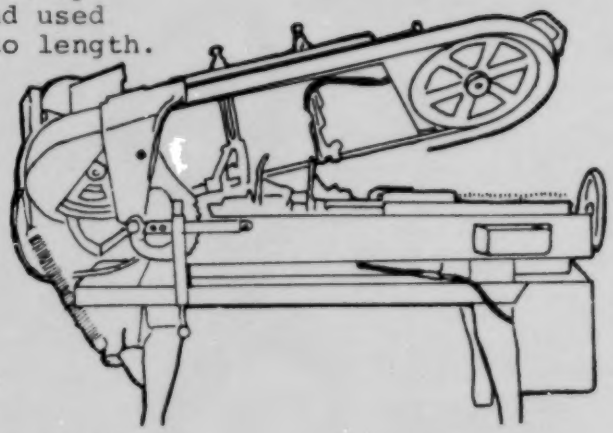


II. Power tools

A. Power hacksaw--used for cutting off metal stock to length using a reciprocating (back and forth like a hand hacksaw) movement.

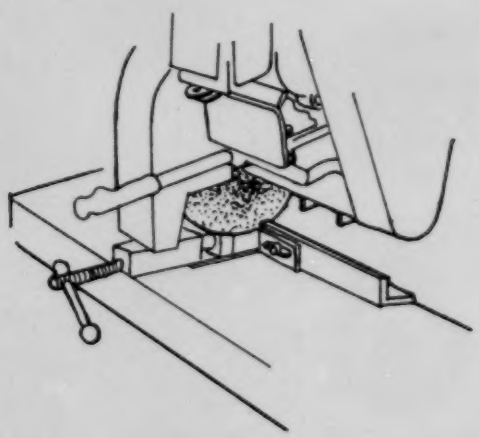


B. Bandsaw--a machine having a continuous saw blade running on and driven by suitable pulleys and used for cutting stock to length.



C. Portable disk grinder/sander--portable electric grinder commonly used in the shop for rough grinding. Uses 7- and 9-inch disk grinding wheels for grinding and wire cup brushes for removal of paint, rust scale, and slag from welds.

D. Abrasive cutoff saw--used for cutting off metal stock by means of a rapidly revolving thin abrasive wheel.



LATHE OPERATOR

ASSIGNMENT SHEET 5--BASIC HAND AND POWER TOOLS

Directions: Match the correct word or words in the right-hand column to the definition in the left-hand column. Place the correct number in the space provided on the left.

_____ A. Used for cutting metal by hand.

_____ B. Used to enlarge the prick mark for drilling holes.

_____ C. Used to scribe or scratch fine lines in metal.

_____ D. Consists of a hardened blade, square head, center head, and a bevel protractor.

_____ E. Its blade is rigid enough for measuring straight surfaces, but flexible enough for measuring curved or irregular surfaces.

_____ F. Used to measure outside diameters and thickness of material.

_____ G. This rule is usually 24" long and is used for bench work only.

_____ H. Used for laying out circles.

_____ I. Because of its sharp point, it is used first to mark the point where the center lines intersect.

_____ J. A machine having a continuous saw blade running on and driven by suitable pulleys.

1. Steel pocket tape
2. Divider
3. Prick punch
4. Bandsaw
5. Steel rule or bench rule
6. Center punch
7. Combination square set
8. Outside micrometer caliper
9. Power hacksaw
10. File
11. Power disk sander/grinder
12. Scribe
13. Hacksaw
14. Abrasive cutoff saw

ASSIGNMENT

_____ K. Used to remove considerable metal, produce a smooth surface for layout work, and produce keen edges on tools.

_____ L. Uses 7- or 9-inch disk grinding wheels for grinding and wire cup brushes for removal of paint, rust scale, and slag from welds.

_____ M. Used for cutting off metal stock to length using a reciprocating (back and forth) movement.

_____ N. Used for cutting off metal by means of a rapidly revolving thin abrasive wheel.

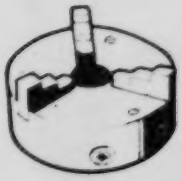
1. Steel pocket tape
2. Divider
3. Prick punch
4. Bandsaw
5. Steel rule or bench rule
6. Center punch
7. Combination square set
8. Outside micrometer caliper
9. Power hacksaw
10. File
11. Power disk sander/grinder
12. Scribe
13. Hacksaw
14. Abrasive cutoff saw

LATHE OPERATOR

INFORMATION SHEET 3--HEADSTOCK ACCESSORIES

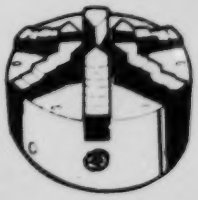
A. Lathe chucks

1. Three-jaw universal--All three jaws of the chuck move together so that the workpiece will be centered without aligning.

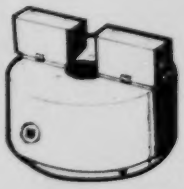


2. Four-jaw independent--A chuck with jaws that move separately so that the workpiece must be aligned.

3. Six-jaw combination--A chuck designed to provide a strong grip on the workpiece.

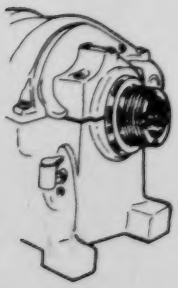


4. Two-jaw universals--A chuck designed to hold workpieces during very simple operations such as polishing or filing.

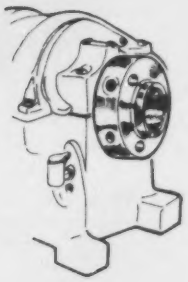


B. Spindles

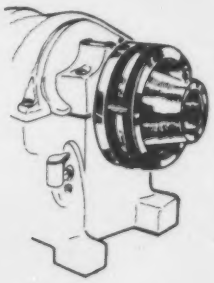
1. Threaded



2. Cam-lock



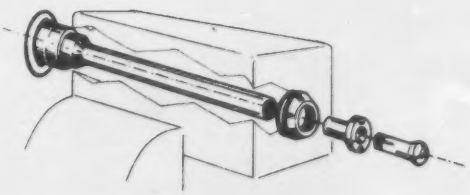
3. Tapered spindle with key drive



C. Faceplates--A round plate that is placed on the spindle to provide a flat surface for mounting workpieces.

(NOTE: When used for turning between centers they are called drive plates)

D. Collets--A chucking device which can quickly clamp against the workpiece as it is punched through the hollow spindle of the lathe.



E. Lathe dogs--The clamps used to drive the workpiece when turning between centers.

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LATHE OPERATOR

ASSIGNMENT SHEET 6--HEADSTOCK ACCESSORIES TERMS

DIRECTIONS: Match the correct word or words in the right column to the correct definition in the left column. Place the appropriate number in the space provided on the left.

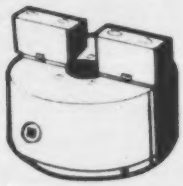
_____ A.	All three jaws of the chuck move together so that the workpiece will be centered.	1. Lathe dogs
_____ B.	A chucking device which can quickly clamp against the workpiece as it is pushed through the spindle.	2. Two-jaw universal
_____ C.	A round plate that is placed on the spindle to provide a flat surface for mounting workpieces.	3. Four-jaw universal
_____ D.	The clamp used to drive the workpiece when turning between centers.	4. Face plates
_____ E.	A chuck with jaws that move separately so that the workpiece must be aligned.	5. Collets
_____ F.	A chuck designed to hold workpieces during simple operations.	6. Three-jaw universal

ASSIGNMENT

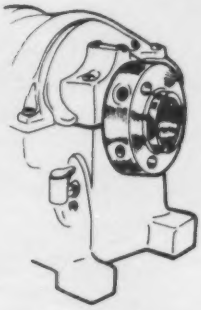
LATHE OPERATOR

ASSIGNMENT SHEET 7--HEADSTOCK ACCESSORIES

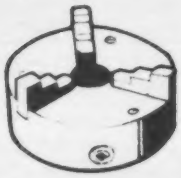
DIRECTIONS: Identify accessories by writing the names under the correct illustration.



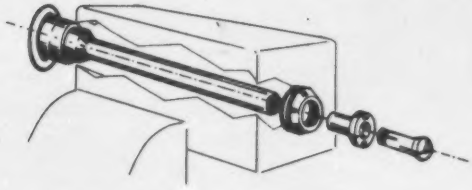
A. _____



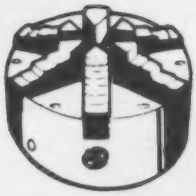
E. _____



B. _____

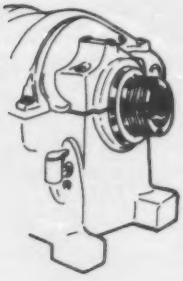


F. _____



C. _____

G. _____



D. _____

H. _____

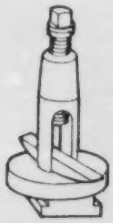
ASSIGNMENT

LATHE OPERATOR

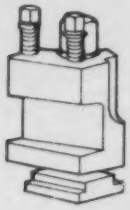
INFORMATION SHEET 4--CARRIAGE ACCESSORIES

A. Tool posts--These hold different tools or tool holders.

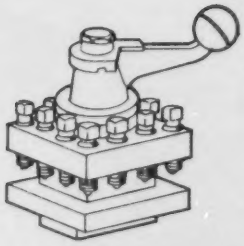
1. Rocker



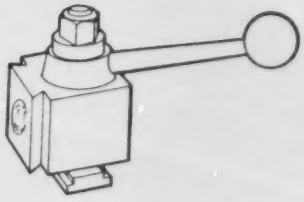
2. Open side or blocks



3. Four-way



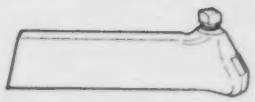
4. Quick-change



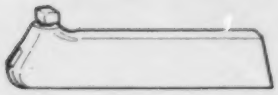
B. Tool holders--These hold various-shaped cutting tools for different operations.

1. Right-hand offset

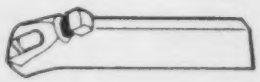
2. Left-hand offset



3. Straight

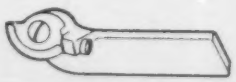


4. Adjustable--Can be used with different sizes of tool steel bits.

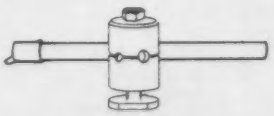


5. Parting--Holds blade like tool steel cutters.

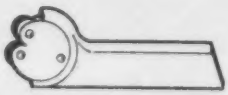
6. Threading--Holds a single-point bit used for threading.



7. Boring bar--Holds bars (usually round) which are used to remove metal from inside the workpiece.

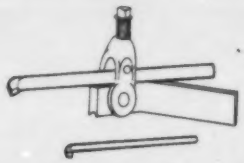


8. Knurling--Available with one or more sets of rollers that have different patterns of grooves.

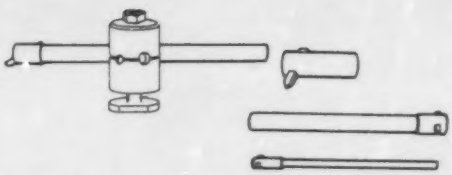


C. Boring bars--These can be designed for internal operations similar to external operations.

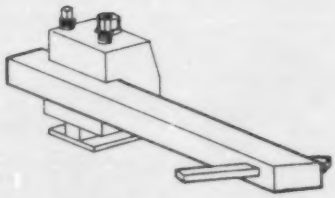
1. Light duty



2. Medium duty



3. Heavy duty

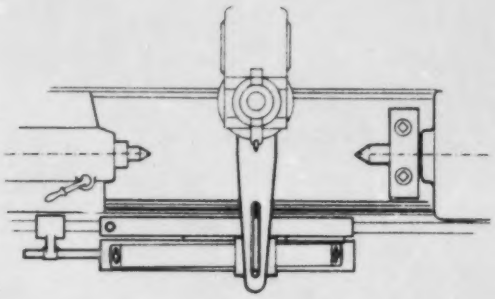


D. Cutting tools

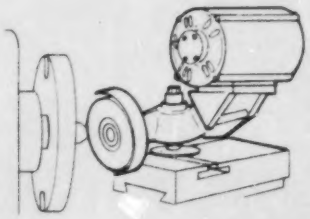
1. Tool steel--Can be ground in any shape such as job right or left-hand turning.

2. Carbide--These cutting tools have formed carbide tips soldered or inserted on tool forms for the specific operation.

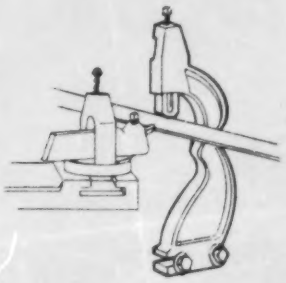
E. Taper attachment--Guides the cutting tool and carriage when a taper is machined.



F. Tool post grinder--Used to grind hardened round workpieces on the lathe.



G. Follow-rest--Attached to the carriage to support long workpieces when they push away from the cutting tool.



LATHE OPERATOR

ASSIGNMENT SHEET 8--CARRIAGE ACCESSORIES TERMS

DIRECTIONS: Match the correct word or words in the right column to the correct definition in the left column. Place the appropriate number in the space provided on the left.

_____ A.	Holds different tools or tool holders.	1. Tool steel
_____ B.	Guides the cutting tool and carriage when a taper is machined.	2. Carbide
_____ C.	Can be ground in any shape.	3. Boring bars
_____ D.	Cutting tools with carbide tips.	4. Tool post
_____ E.	Holds various-shaped cutting tools.	5. Tool holders
_____ F.	Designed for internal operations.	6. Taper attachment
_____ G.	Attached to the carriage to support long workpieces.	7. Follow-rest
_____ H.	Used to grind hard round workpieces.	8. Tool post grinder

ASSIGNMENT

INFORMATION SHEET 5--TAILSTOCK ACCESSORIES AND OTHER ACCESSORIES

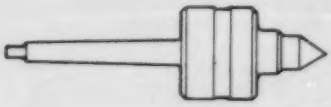
A. Centers--Cone-shaped points which provide a center line and support for the workpiece.

1. Solid

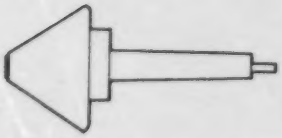
a. Live--Means that it rotates with the spindle.

b. Dead--Means that it does not move.

2. Ball bearing



3. Pipe



B. Sleeves--Hollow tapered devices used to adapt tapered shank cutting tools to be tapered tailstock (or redstock) spindle.

C. Drill chuck--Inserted in the tailstock to hold center drills or straight shank cutting tools (drills etc.) while the stock rotates.

D. Steady rest--A support for long workpieces being turned without the tailstock for support.

(NOTE: The guides in the steady rest will be roller bearings or brass bars.)

E. Carriage stop--A device that attaches to the bed of the lathe to stop the travel of the carriage at the specified point.

F. Mandrel--A slightly tapered steel shaft that supports work that cannot be held by any other method for machining between centers.

(NOTE: This allows the surfaces of the workpiece to be machined without having to turn the part around in a chuck.)

LATHE OPERATOR

ASSIGNMENT SHEET 9--TAILSTOCK AND OTHER ACCESSORIES

DIRECTIONS: Match correct word or words in the right column to the correct definition in the left column. Place the appropriate number in the space provided on the left.

_____ A.	Cone-shaped points for center line support.	1. Sleeves
_____ B.	A support for long workpieces.	2. Drill chuck
_____ C.	Device to stop the travel of the carriage.	3. Centers
_____ D.	Tapered shaft to support work that cannot be held by any other method.	4. Carriage stop
_____ E.	Inserted in the tailstock to hold center drills.	5. Mandrel
_____ F.	Hollow tapered devices to adapt tapered shank cutting tools.	6. Steady rest

ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 6--TERMS AND DEFINITIONS

A. Centering--Aligning a workpiece on center line of the spindle of the lathe.

(NOTE: There are many methods of centering the workpiece, but the dial indicator is usually used when centering stock in the four-jaw chuck.)

B. Cutting speed (CS)--The speed of the outside edge of the workpiece which is stated in feet per minute (FPM).

C. Depth of cut--The amount of stock removed in one pass of the cutting tool.

D. Feed--The distance the tool moves with each revolution of the workpiece.

E. Material--The type of metal the workpiece is made of.

F. Pressfit--When the sizes of the two parts are so close that they must have force applied for them to fit together.

G. Relief--A small groove cut around metal with a parting tool.

(NOTE: The relief cut provides a stopping spot for threads or machining operation.)

H. Revolutions per minute (RPM)--The number of times the workpiece rotates in one minute.

I. Specified--The size called for on a blueprint.

J. Taper per foot--The difference in diameters for one foot in length of a coned-shaped part.

(NOTE: Taper per inch is also used to show taper sizes.)

K. Tool steel--A hard metal used to make cutting tools for the lathe.

(NOTE: High-speed steel tools are used for higher speeds and carbon steel tools are used for average cutting.)

L. Travel--The movement of the carriage along the bed or the movement of the cross slide and compound rest across the carriage.

LATHE OPERATOR

ASSIGNMENT SHEET 10--TERMS AND DEFINITIONS

DIRECTIONS: Read the following statements and identify as True or False. Write "T" or "F" in the space provided on the left.

_____ 1. R.P.M. stands for rate per man.

_____ 2. Material is the type of metal the workpiece is made of.

_____ 3. When the sizes of the two parts are so close that they must have force applied it is called pressfit.

_____ 4. Relief is a large groove cut around metal with a parting tool.

_____ 5. Depth of cut is the amount of stock removed in several passes of the cutting tool.

_____ 6. Centering is aligning a workpiece on center line of the spindle of the lathe.

_____ 7. Specified is the size called for on a blueprint.

_____ 8. Travel is the movement of the bed along the carriage.

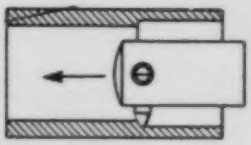
_____ 9. Cutting speed is the speed of the outside edge of the workpiece.

_____10. Taper per foot is the difference in diameters for one foot in length of a cone-shaped part.

ASSIGNMENT

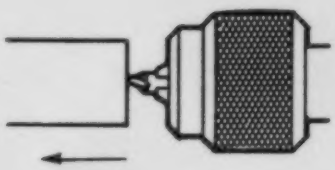
INFORMATION SHEET 7--BASIC LATHE OPERATIONS

A. Boring--Removing metal from the inside of the workpiece to enlarge the inside diameter or shape the inside.



B. Center drilling--Producing a cone-shaped hole in the end of a workpiece.

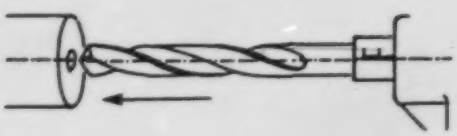
(NOTE: This hole is used to center the workpiece when turning between centers or for alignment when starting a a drill kit.)



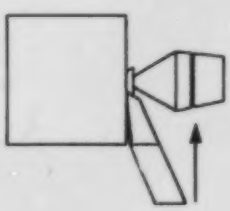
C. Chamfering--Producing an angle on the edge of a workpiece.

(NOTE: This is done for deburring and before threading a workpiece.)

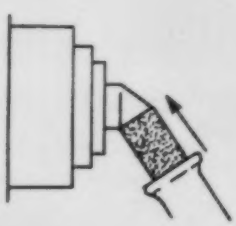
D. Drilling--Producing a hole in the workpiece so other operations may follow.



E. Facing--Squaring and smoothing the end of a workpiece.

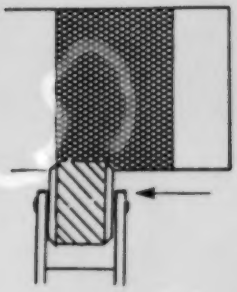


F. Grinding--Removing hardened metal on the lathe which could not be cut with regular lathe tools.



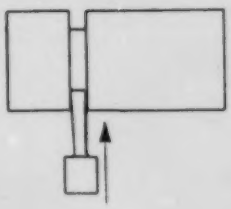
G. Knurling--Producing a rough pattern on the surface of the workpiece.

(NOTE: This is done to provide a gripping surface or to enlarge the diameter of the workpiece.)

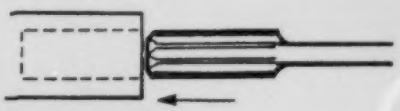


H. Parting--Cutting a workpiece into two pieces.

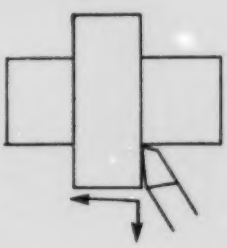
(NOTE: A parting tool is also used to cut grooves or recesses in the workpiece.)



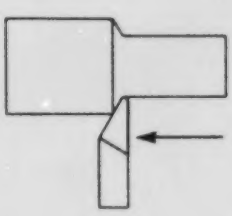
I. Reaming--Smoothing the surfaces of a hole to an exact size.



J. Shoulder turning--Producing a square, angular, or rounded corner on a workpiece.



K. Straight turning--Removing metal a specified length on a workpiece to reduce its diameter.

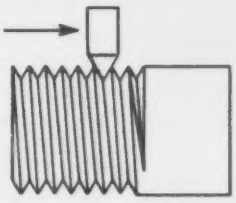


L. Taper turning--Producing a cone-shaped area on the workpiece.

(NOTE: The difference in diameters will be according to specified sizes.)

M. Threading--Producing V-shaped grooves around a workpiece that advance along the shaft specified distances.

(NOTE: Threads are placed on fasteners of all shapes.)



LATHE OPERATOR

ASSIGNMENT SHEET 11--OPERATIONS

DIRECTIONS: Match the operation with the pictures.

_____ 1. Chamfering

_____ 2. Taper turning

_____ 3. Reaming

_____ 4. Boring

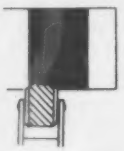
_____ 5. Facing

_____ 6. Shoulder turning

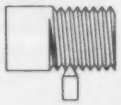
_____ 7. Knurling

_____ 8. Threading

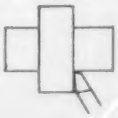
A.



B.

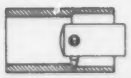


C.

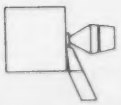


D.

E.



F.



G.

H.

ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 8--THINGS TO CONSIDER WHEN RUNNING SPEEDS AND FEEDS

A. Type of metal--Different types of metals vary in hardness which affects their ability to be cut.

B. Depth of cut--Feed is usually slower on larger cuts.

C. Finish required--A slower feed with a faster RPM is used on finishing cuts, and a slower feed with a slower RPM is used on roughing cuts.

D. Type of cutter--Carbide cutters will stand higher RPM with faster feeds than tool steel cutters.

E. Cutting speed table--A table used to find the correct cutting speed with feet per minute and diameter of material.

F. TPF--Taper per foot.

G. RPM--Revolutions per minute.

ASSIGNMENT SHEET 12--FIGURING RPM

DIRECTIONS: Using the chart or formulas shown below, determine the correct RPM for each situation given below.

A. Figure what RPM would be used for each problem below. Use the chart shown.

EXAMPLE: The RPM for turning a 1" diameter piece of stock with a cutting speed of 100 feet per minute would be 437.

TABLE OF CUTTING SPEEDS—REVOLUTIONS PER MINUTE

Feet per Min.	DIAMETER, INCHES											
	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8	1 1/2	2	3
30	458	306	229	183	153	131	115	102	83.3	76.4	57.3	38.2
40	611	407	306	244	204	175	153	136	111	102	76.4	50.9
50	764	509	382	306	255	218	191	170	139	127	95.5	63.7
60	917	611	458	367	306	262	229	204	167	153	115	76.4
70	1070	713	535	428	357	306	267	238	194	178	134	89.1
80	1222	815	611	489	407	349	306	272	222	204	153	102
90	1375	917	688	550	458	393	344	306	250	229	172	115
100	1528	1019	764	611	509	437	382	340	278	255	191	127
125	1910	1273	955	764	637	546	477	424	347	318	239	159
150	2292	1528	1146	917	764	655	573	509	417	382	286	191
175	2674	1783	1337	1070	891	764	668	594	486	446	334	223
200	3056	2037	1528	1222	1019	873	764	679	556	509	382	255
250	3820	2546	1910	1528	1273	1091	955	849	694	637	477	318
300	4584	3056	2292	1833	1528	1310	1146	1019	833	764	573	382
350	5348	3565	2674	2139	1783	1528	1337	1188	972	891	668	446
400	6112	4074	3056	2445	2037	1746	1528	1358	1111	1019	764	509
500	7639	5093	3820	3056	2546	2183	1910	1698	1389	1273	955	637
600	9167	6112	4584	3667	3056	2619	2292	2037	1667	1528	1146	764

DIAMETER OF STOCK	CUTTING SPEED	RPM
1. 3/8"	80	
2. 1/2"	60	
3. 5/8"	40	
4. 3/4"	70	
5. 7/8"	100	
6. 1"	90	
7. 1 1/8"	125	
8. 1 3/8"	80	
9. 1 1/2"	60	
10. 3"	300	

B. Figure the RPM for each problem below. Use the formula:

$$RPM = \frac{4 \times \text{Cutting Speed}}{\text{Diameter of Stock}}$$

EXAMPLE: The RPM for a 1" diameter piece of mild steel stock with a cutting speed of 80 would be:

$$\frac{4 \times 80}{1"} = \frac{320}{1} = 320 \text{ RPM}$$

DIAMETER OF STOCK	CUTTING SPEED	RPM
1. 1"	100	
2. 1"	60	
3. 1½" (1.5)	90	
4. 2"	30	
5. 2½" (2.5)	70	
6. ⅛" (.250)	80	
7. ½" (.500)	100	
8. 3"	300	
9. 3/8" (.375)	60	
10. 7/8" (.875)	70	

LATHE OPERATOR

ASSIGNMENT SHEET 13--FIGURE TAPER PER FOOT

DIRECTIONS: Use the following formula to figure the taper per foot (TPF) for each problem below.

$$\frac{\text{Large diameter - Small diameter}}{\text{Length of taper}} \times 12 = \text{TPF}$$

EXAMPLE: $\frac{2 - \frac{1}{2}}{3} \times 12 = \text{TPF}$

$\frac{1\frac{1}{2}}{3} \times 12 - \text{TPF}$

$.5 \times 12 = \text{TPF}$

$6 = \text{TPF}$

	LARGE DIAMETER	SMALL DIAMETER	LENGTH OF TAPER	TAPER PER FOOT
A.	1.5"	1"	3"	
B.	1"	.750"	4"	
C.	1.125"	.625"	6"	
D.	2"	1.875"	5"	
E.	.625"	.500"	3.500"	
F.	2.750"	2.1200"	4.250"	
G.	1.437"	1.200"	8"	
H.	3.12"	2.625"	2"	
I.	1.5"	1.375"	4.125"	
J.	.750"	.250"	.875"	

ASSIGNMENT

LATHE OPERATOR

ASSIGNMENT SHEET 14--FIGURE TAILSTOCK OFFSET

DIRECTIONS: Use the formula shown below to figure the tailstock offset for each of the following problems.

$$\frac{\text{Length of workpiece}}{12} \times \frac{\text{Taper Per Foot}}{2} = \text{Offset}$$

LENGTH OF WORKPIECE	TAPER PER FOOT	OFFSET
A. 12"	.500	
B. 8"	.375	
C. 6"	.250	
D. 4"	1"	
E. 3.5"	3"	
F. 6.250"	.90"	
G. 5.875"	.375"	
H. 9.750"	2"	
I. 10"	4"	
J. 10.187"	4"	

ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 9--KNURLING

(NOTE: Can be used if students have lathes at their training stations.)

I. Tools and Equipment

A. Chuck (3- or 4-Jaw)

B. Knurling tool and holder

C. Workpiece

D. Cutting oil

E. Shop rag

II. Procedures

CAUTION: Stop the lathe when making any adjustments.

A. Chuck the workpiece.

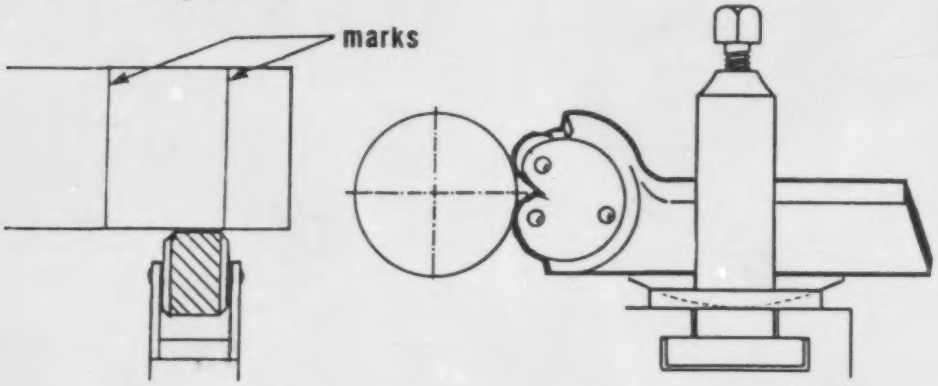
(NOTE: The workpiece should have as little as possible extending from the chuck.)

B. Set up the correct feed and speed for knurling.

(NOTE: The RPM should be as slow as possible and a fast feed.)

C. Mark off the section of the workpiece to be knurled.

D. Place the tool in the tool post so it is 90° and on center of the workpiece.



(NOTE: Both wheels must be squarely against the workpiece.)

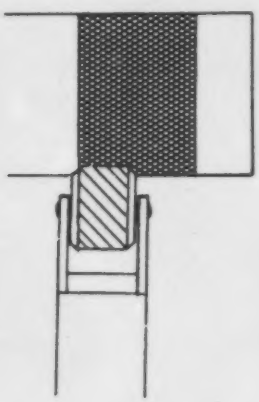
E. Start the lathe and dial the crossfeed toward the workpiece until a pattern is clearly formed.

F. Start the automatic feed.

G. Apply coolant or cutting fluid often.

H. Stop the machine when the knurls reach the left mark.

(NOTE: Do not disengage the feed.)



I. Reverse the spindle direction and apply more crossfeed pressure.

J. Stop the tool at the right starting point.

K. Make additional passes until the specified knurl is formed.

L. Clean up the lathe and turn in the tools.

M. Turn in the workpiece to your instructor.

LATHE OPERATOR

ASSIGNMENT SHEET 15--KNURLING

A. List the tools and equipment to be used for knurling.

1. 4.

2. 5.

3.

B. Explain the procedures used for knurling.

ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 10--TOOL POST GRINDING

(NOTE: Can be used if students have lathes at their training stations.)

I. Tools and equipment

A. Tool post grinder

B. Workpiece (or lathe center)

C. Shop rag

II. Procedures

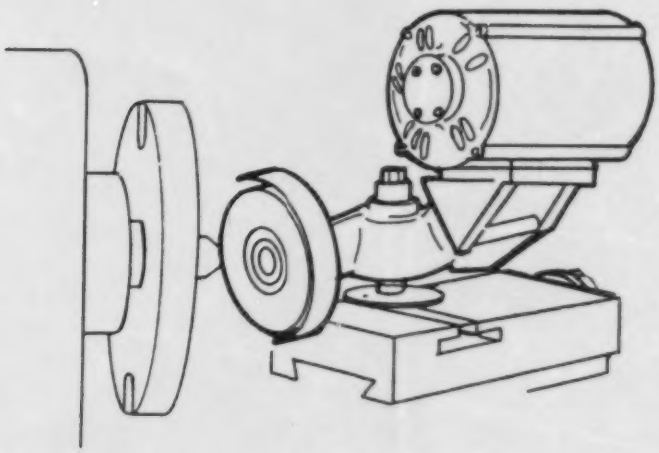
CAUTION: Stop the lathe when making any adjustments.

A. Place the center in the headstock.

(NOTE: Remove the faceplate or chuck.)

B. Align the toolpost grinder at 90° to the compound rest and fasten securely.

C. Adjust the compound rest to a 30° angle from center line.



D. Reverse the direction of rotation of the lathe spindle.

E. Set the RPM of the lathe.

F. Adjust the grinder to the starting point.

G. Start the lathe and the grinder.

H. Feed the grinder into the center with the cross slide.

(NOTE: Avoid heavy cuts.)

I. Feed the grinder along with the compound rest crank.

J. Make several passes until the workpiece is smoothly, evenly ground.

(NOTE: Be sure to move the grinder away from the workpiece before stopping the lathe.)

K. Clean up the lathe and turn in the tools.

L. Hand in the workpiece to your instructor.

LATHE OPERATOR

ASSIGNMENT SHEET 16--TOOL POST GRINDING

A. List the tools and equipment to be used for tool post grinding.

1.

2.

3.

B. Explain the procedures used for tool post grinding.

ASSIGNMENT

LATHE OPERATOR

INFORMATION SHEET 11--FILING AND POLISHING

(NOTE: Can be used if students have lathes at their training stations.)

I. Tools and equipment

A. Chuck (3- or 4-jaw)

B. Workpiece

C. Parallel lathe file

D. Emery cloth

E. File card

F. Micrometers

II. Procedures

CAUTION: Stop the lathe before making any adjustments.

A. Chuck the workpiece

CAUTION: When filing or polishing a workpiece between centers, stay clear of the lathe dog.

B. Filing

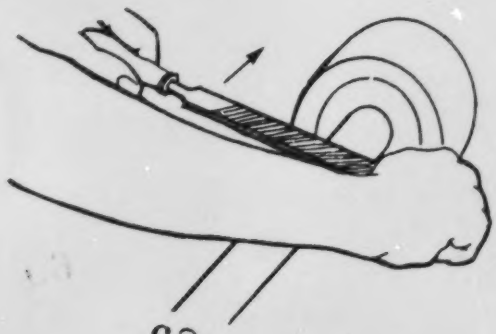
1. Set the RPM at the correct speed for filing.

(NOTE: The RPM should be run faster for filing and polishing if the workpiece can be rotated at high speeds.)

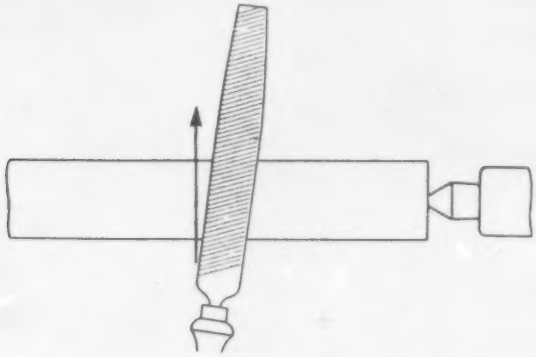
2. Start the lathe

(NOTE: Move the carriage out of the way.)

3. File across the workpiece at an angle from the tailstock end of the lathe.



4. Use long strokes with a slight angle on the file.



5. File the workpiece to within .001 to .002 for polishing.

C. Polishing

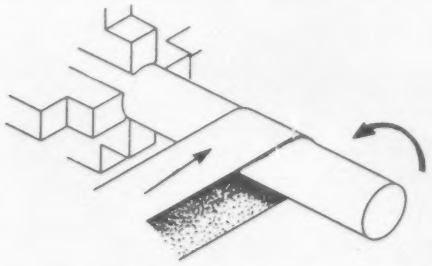
1. Set the RPM at the correct speed for polishing.

   (NOTE: Run the lathe at 3,000 to 5,000 RPM for polishing.)

2. Start the lathe.

   (NOTE: Move the carriage out of the way.)

3. Place the emery cloth around the workpiece.



4. Move the emery cloth back and forth and up and down the length of the workpiece.

5. Stop the machine and check the workpiece several times during polishing.

6. Polish the workpiece to the specified diameter.

D. Clean up the lathe and turn in the tools.

E. Hand in the workpiece to your instructor.

LATHE OPERATOR

ASSIGNMENT SHEET 17--FILING AND POLISHING

A. List the tools and equipment needed for filing and polishing.

1. 4.

2. 5.

3. 6.

B. Explain the procedures for filing and polishing.

ASSIGNMENT

INFORMATION SHEET 12--CLEANING AND LUBRICATING THE LATHE

(NOTE: Can be used if students have lathes at their training stations.)

I. Tools and equipment

A. Cleaning brush

B. Shop rag

C. Oil can

D. Cleaning solvent

E. Broom

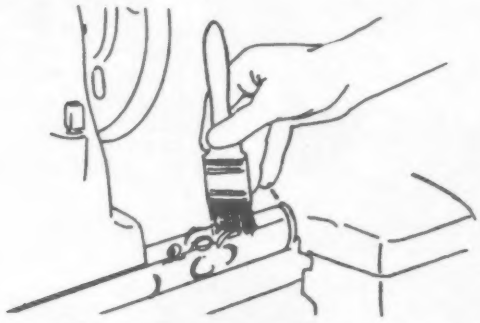
F. Dust pan

G. Floor sweep

II. Procedures

CAUTION: Stop the lathe before making any adjustments.

A. Brush all chips from the carriage.

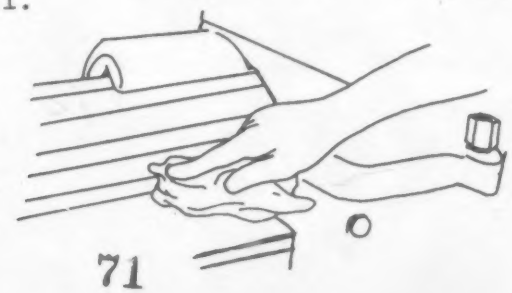


B. Wipe all dirt and oil from the lathe with a shop rag.

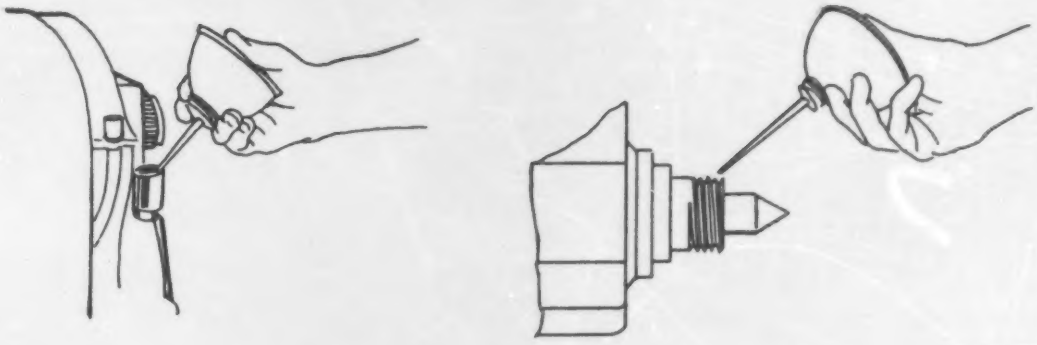
C. Wipe the lathe down with cleaning solvent.

D. Dry the lathe with a shop rag.

E. Apply a thin coat of oil to all surfaces of the lathe that need oil.



F. Oil spindle threads or cams and any oilers on the lathe.



(NOTE: Some lathe headstocks and carriages have oil sight glasses and should be checked regularly.)

G. Oil the motor and other oilers in the motor housing if required.

H. Wipe off the exterior surfaces of the lathe.

I. Sweep up chips around the lathe.

J. Pick up chips with the dust pan.

K. Sprinkle floor sweep on any oily spots.

L. Place cleaning rags, solvent, oil, and equipment in proper storage.

LATHE OPERATOR

ASSIGNMENT SHEET 18--CLEANING AND LUBRICATING THE LATHE

A. List the tools and equipment needed for cleaning and lubricating the lathe.

1. 5.

2. 6.

3. 7.

4.

B. Explain the procedures for cleaning and lubricating the lathe.

ASSIGNMENT

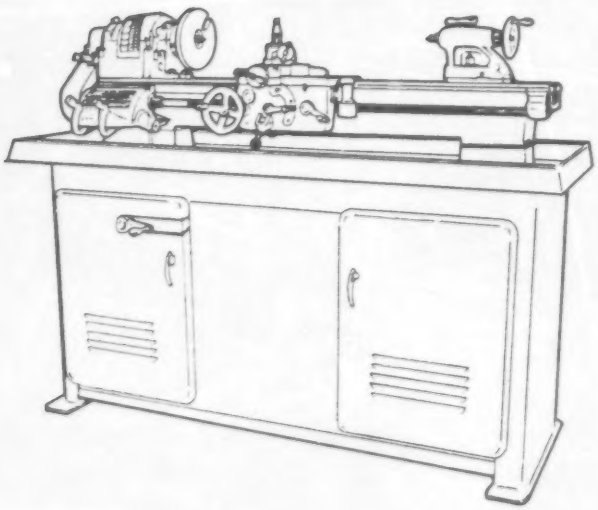
LATHE OPERATOR

TEST PART 1

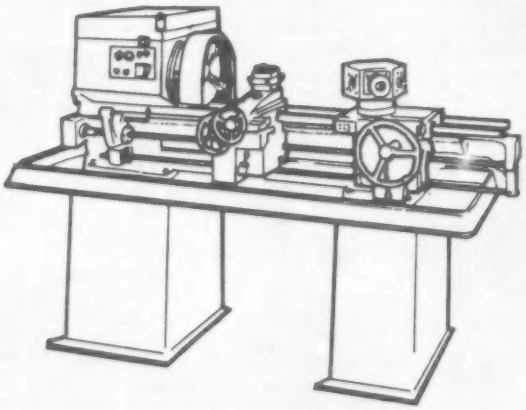
1. Define and describe the function of the engine lathe.

2. Identify the types of lathes used in industry by writing each of the following names by the correct illustration.

Engine



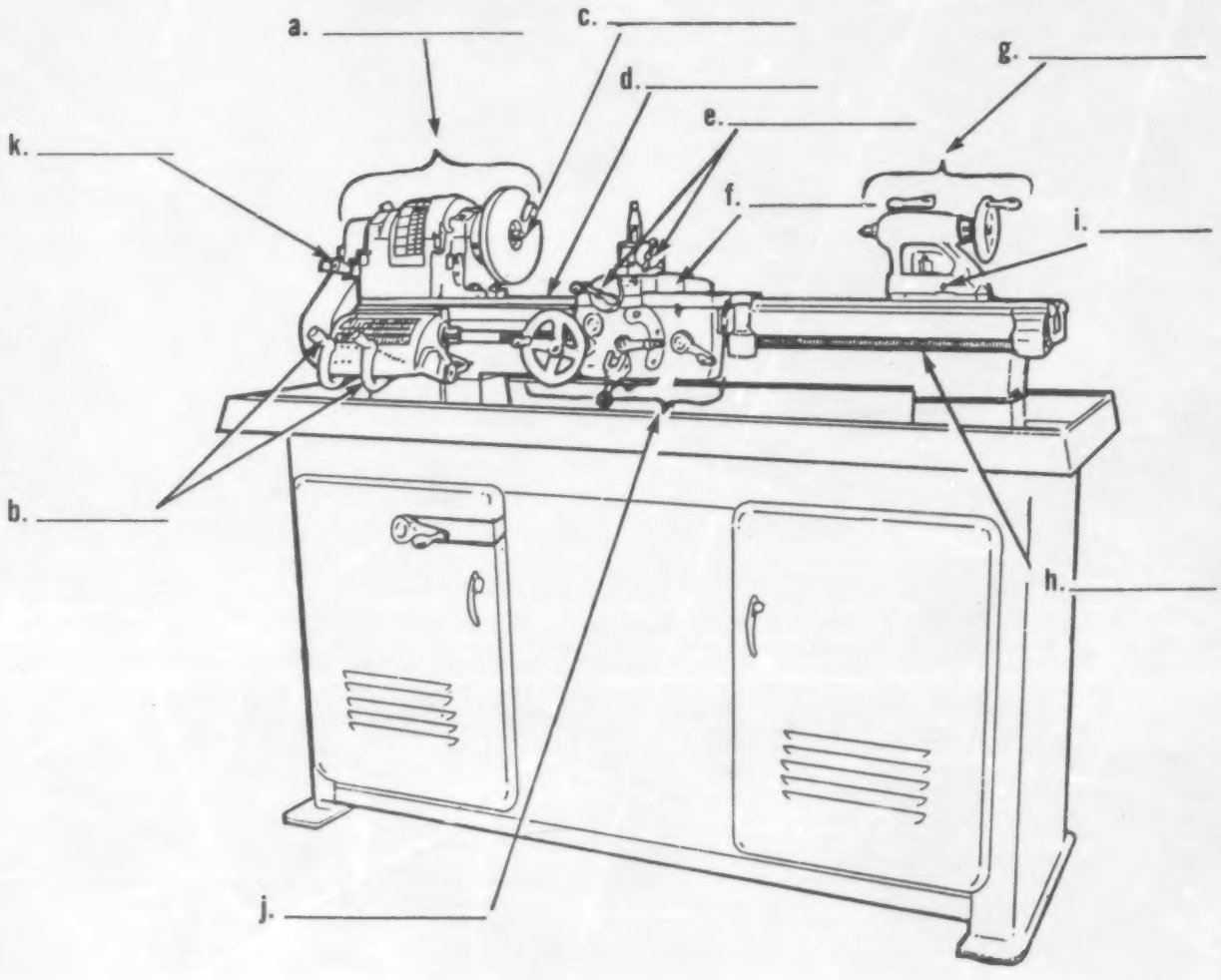
Turrett



a. _____ b. _____

3. Identify the main parts of the lathe by writing each of the following names of parts in the spaces provided.

Carriage	Compound rest
Feed reverse lever	Bed
Headstock	Set screw
Spindle	Screw-feed levers
Compound cross-feed cranks	Tailstock
Lead screw	



4. Select the correct safety rules to be followed when operating a lathe by circling the number of the correct answer.

   a. The proper protective clothing to wear when operating a lathe would include:

      (1) a cap, long-sleeved shirt, and heavy socks.

      (2) a hard hat, knee pads, and soft-soled shoes.

      (3) eye glasses, snug-fitting clothing, and a protective apron or coveralls.

   b. You should operate a lathe

      (1) only after receiving proper instructions.

      (2) when you see others operating the lathes.

      (3) as soon as you can get the tools together.

   c. Make adjustments on the lathe

      (1) only when it is stopped.

      (2) with long-handled tools.

      (3) without stopping the spindle.

   d. Tools and accessories should be placed

      (1) on the ways of the bed.

      (2) on the saddle.

      (3) on a board or tool rack.

   e. Proper use of the lathe should include:

      (1) keeping guards in place and repair of faulty parts.

      (2) operating the lathe until a faulty part completely breaks.

      (3) starting the lathe without checking for loose parts or control settings.

   f. To avoid horseplay, one should

      (1) sit to one side of the lathe, unnoticed.

      (2) leave the lathe to run by itself.

      (3) not talk to another lathe operator while the lathe is running.

LATHE OPERATOR

TEST PART 2

Directions: Match the correct word or words in the right-hand column to the definition in the left-hand column. Place the correct number in the space provided on the left.

_____ A.	Used for cutting metal by hand.	1. Steel pocket tape
_____ B.	Used to enlarge the prick mark for drilling holes.	2. Divider
_____ C.	Used to scribe or scratch fine lines in metal.	3. Prick punch
_____ D.	Consists of a hardened blade, square head, center head, and a bevel protractor.	4. Bandsaw
_____ E.	Its blade is rigid enough for measuring straight surfaces, but flexible enough for measuring curved or irregular surfaces.	5. Steel rule or bench rule
_____ F.	Used to measure outside diameters and thickness of material.	6. Center punch
_____ G.	This rule is usually 24" long and is used for bench work only.	7. Combination square set
_____ H.	Used for laying out circles.	8. Outside micrometer caliper
_____ I.	Because of its sharp point, it is used first to mark the point where the center lines intersect.	9. Power hacksaw
_____ J.	A machine having a continuous saw blade running on and driven by suitable pulleys.	10. File
		11. Power disk sander/grinder
		12. Scribe
		13. Hacksaw
		14. Abrasive cutoff saw

_____ K. Used to remove considerable metal, produce a smooth surface for layout work, and produce keen edges on tools.

_____ L. Uses 7- or 9-inch disk grinding wheels for grinding and wire cup brushes for removal of paint, rust scale, and slag from welds.

_____ M. Used for cutting off metal stock to length using a reciprocating (back and forth) movement.

_____ N. Used for cutting off metal by means of a rapidly revolving thin abrasive wheel.

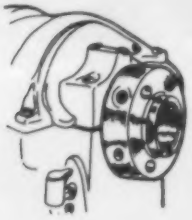
1. Steel pocket tape
2. Divider
3. Prick punch
4. Bandsaw
5. Steel rule or bench rule
6. Center punch
7. Combination square set
8. Outside micrometer caliper
9. Power hacksaw
10. File
11. Power disk sander/grinder
12. Scribe
13. Hacksaw
14. Abrasive cutoff saw

LATHE OPERATOR

TEST PART 3

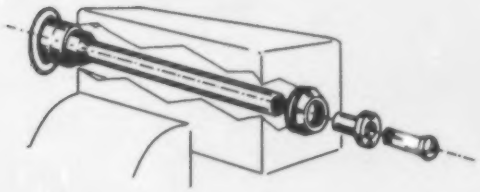
1. Identify the accessories available for a lathe headstock by writing each of the following names by the correct illustration.

Collets
Lathe dog
Faceplate
Three-jaw universal chuck
Four-jaw independent chuck
Camlock spindle



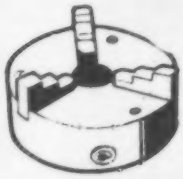
a. _____

b. _____



c. _____

d. _____



e. _____

f. _____

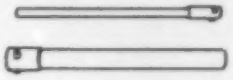
LATHE OPERATOR

TEST PART 4

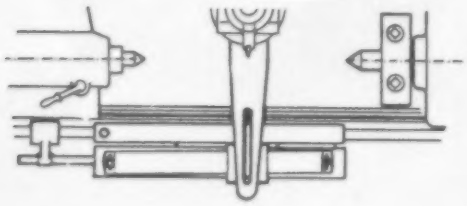
1. Identify the accessories used on the lathe carriage by writing the names listed below the correct illustration.

Rocker tool post
Follow-rest
Taper attachment
Knurling tool
Four-way tool post
Tool post grinder
Right-hand roughing tool
Boring bar
Right-hand offset tool holder
Open-side tool post

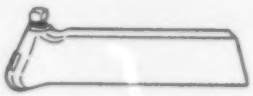
a. _____



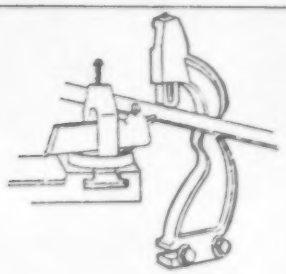
b. _____



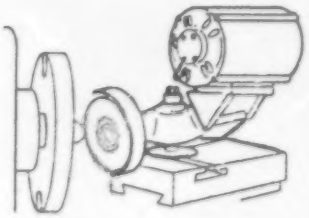
c. _____



d. _____



e. _____

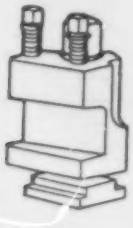


f. _____

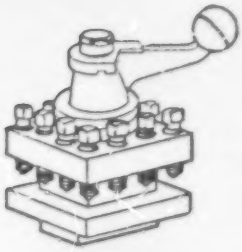
Rocker tool post
Follow-rest
Taper attachment
Knurling tool
Four-way tool post

Tool post grinder
Right-hand roughing tool
Boring bar
Right-hand offset tool holder
Open-side tool post

g. _____



i. _____



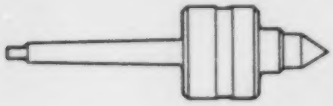
h. _____

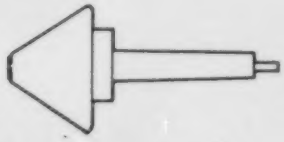
LATHE OPERATOR

TEST PART 5

1. Identify the accessories used on a lathe tailstock by writing each of the following names by the correct illustration.

   Ball bearing center Pipe center Solid center





a. _____ c. _____

b. _____

LATHE OPERATOR

TEST PART 6

1. Match terms associated with the operation of a lathe to the correct definition by placing the number of each term on the right in the blanks on the left.

_____ a.	The number of times the workpiece rotates in one minute.	1. Centering
_____ b.	Term applied to two parts that must be forced together.	2. Cutting speed
_____ c.	The movement of the carriage along the bed or the cross-slide and compound rest across the carriage.	3. Depth of cut
_____ d.	The distance the tool moves with each revolution of the workpiece.	4. Feed
_____ e.	Aligning a workpiece on the centerline of the spindle of the lathe.	5. Material
_____ f.	The amount of stock removed in one pass of the cutting tool.	6. Pressfit
_____ g.	The size called for on a blueprint.	7. Relief
_____ h.	A small groove cut around the workpiece with a parting tool.	8. Revolutions per minute
_____ i.	The speed of the outside edge of the workpiece which is stated in feet per minute.	9. Specified
_____ j.	The difference in diameters over a foot in length of a cone-shaped part.	10. Taper per foot
_____ k.	A hard metal used to make cutting tools for the lathe.	11. Tool steel
_____ l.	The type of metal the workpiece is made of.	12. Travel

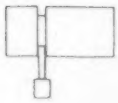
LATHE OPERATOR

TEST PART 7

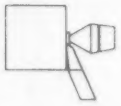
1. Identify each of the operations performed on a lathe by writing the correct name of each in the blanks provided.

a. _____

b. _____



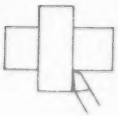
c. _____



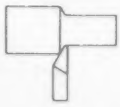
d. _____

e. _____

f. _____



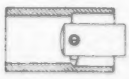
g. _____



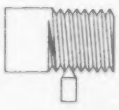
h. _____

i. _____

j. _____



k. _____



l. _____

LATHE OPERATOR

TEST PART 8

1. Point out the things to consider when you are setting feeds or speeds on the lathe by placing a "✓" in front of each.

_____	a.	Type of cutter	f. Depth of cut
_____	b.	Length of bed on lathe	g. R.P.M.
_____	c.	Type of chuck	h. Cutting speed table
_____	d.	Finish required	i. T.P.F.
_____	e.	Type of metal	

2. Explain why, in your own words, these things needed to be considered.

3. Work the following problems.

DIRECTIONS: Using the chart or formulas shown below, determine the correct RPM for each situation given below.

A. Figure what RPM would be used for each problem below. Use the chart shown.

EXAMPLE: The RPM for turning a 1" diameter piece of stock with a cutting speed of 100 feet per minute would be 437.

TABLE OF CUTTING SPEEDS—REVOLUTIONS PER MINUTE

Feet per Min.	DIAMETER, INCHES											
	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8	1 1/2	2	3
30	458	306	229	183	153	131	115	102	83.3	76.4	57.3	38.2
40	611	407	306	244	204	175	153	136	111	102	76.4	50.9
50	764	509	382	306	255	218	191	170	139	127	95.5	63.7
60	917	611	458	367	306	262	229	204	167	153	115	76.4
70	1070	713	535	428	357	306	267	238	194	178	134	89.1
80	1222	815	611	489	407	349	306	272	223	204	153	102
90	1375	917	688	550	458	393	344	306	250	229	172	115
100	1528	1019	764	611	509	437	382	340	278	255	191	127
125	1910	1273	955	764	637	546	477	424	347	318	239	159
150	2292	1528	1146	917	764	655	573	509	417	382	286	191
175	2674	1783	1337	1070	891	764	668	594	486	446	334	223
200	3056	2037	1528	1222	1019	873	764	679	556	509	382	255
250	3820	2546	1910	1528	1273	1091	955	849	694	637	477	318
300	4584	3056	2292	1833	1528	1310	1146	1019	833	764	573	382
350	5348	3565	2674	2139	1783	1528	1337	1188	972	891	668	446
400	6112	4074	3056	2445	2037	1746	1528	1358	1111	1019	764	509
500	7639	5093	3820	3056	2546	2183	1910	1698	1389	1273	955	637
600	9167	6112	4584	3667	3056	2619	2292	2037	1667	1528	1146	764

DIAMETER OF STOCK	CUTTING SPEED	RPM
1. 3/8"	80	
2. 1/2"	60	
3. 5/8"	40	
4. 3/4"	70	
5. 7/8"	100	
6. 1"	90	
7. 1 1/8"	125	
8. 1 3/8"	80	
9. 1 1/2"	60	
10. 3"	300	

B. Figure the RPM for each problem below. Use the formula:

$$RPM = \frac{4 \times \text{Cutting Speed}}{\text{Diameter of Stock}}$$

EXAMPLE: The RPM for a 1" diameter piece of mild steel stock with a cutting speed of 80 would be:

$$\frac{4 \times 80}{1"} = \frac{320}{1} = 320 \text{ RPM}$$

DIAMETER OF STOCK	CUTTING SPEED	RPM
1. 1"	100	
2. 1"	60	
3. 1½" (1.5)	90	
4. 2"	30	
5. 2½" (2.5)	70	
6. ¼" (.250)	80	
7. ½" (.500)	100	
8. 3"	300	
9. 3/8" (.375)	60	
10. 7/8" (.875)	70	

C. DIRECTIONS: Use the following formula to figure the taper per foot (TPF) for each problem below.

$$\frac{\text{Large diameter - Small diameter}}{\text{length of taper}} \times 12 = \text{TPF}$$

EXAMPLE: $\frac{2 - \frac{1}{2}}{3} \times 12 = \text{TPF}$

$\frac{1\frac{1}{2}}{3} \times 12 = \text{TPF}$

$.5 \times 12 = \text{TPF}$

$6 = \text{TPF}$

	LARGE DIAMETER	SMALL DIAMETER	LENGTH OF TAPER	TAPER PER FOOT
1.	1.5"	1"	3"	
2.	1"	.750"	4"	
3.	1.125"	.625"	6"	
4.	2"	1.875"	5"	
5.	.625"	.500"	3.500"	
6.	2.750"	2.1200"	4.250"	
7.	1.437"	1.200"	8"	
8.	3.12"	2.625"	2"	
9.	1.5"	1.375"	4.125"	
10.	.750"	.250"	.875"	

D. DIRECTIONS: Use the formula shown below to figure the tail-stock offset for each of the following problems.

$$\frac{\text{Length of workpiece}}{12} \times \frac{\text{Taper Per Foot}}{2} = \text{Offset}$$

	LENGTH OF WORKPIECE	TAPER PER FOOT	OFFSET
1.	12"	.500	
2.	8"	.375	
3.	6"	.250	
4.	4"	1"	
5.	3.5"	3"	
6.	6.250"	.90"	
7.	5.875"	.375"	
8.	9.750"	2"	
9.	10"	4"	
10.	10.187"	4"	